THURSDAY, JUNE 10, 1875

THE METEOROLOGICAL OFFICE

Quarterly Weather Report of the Meteorological Office. Published by the authority of the Meteorological Committee, January 1869, to September 1873. Hourly Readings from the self-recording instruments at the seven Observatories in connection with the Meteorological Office, January to September 1874.

THE self-recording instruments which have been in operation at the seven Observatories of the Meteorological Committee since January 1869, may be regarded as the best and most complete anywhere existing for recording continuously the atmospheric pressure, temperature, humidity and rainfall, and the velocity and direction of the wind. To ensure correctness in the work, and accurate tabulation of the results, minute regulations with respect to the officials at the outlying Observatories, the assistant at the Central Observatory, and the director of the Central Observatory, were laid down in the Committee's Report for 1868, p. 62. Thus, as regards the thermograph, twenty-seven regulations were laid down, one of the most important of these being the 25th, by which it was provided that forty remeasurements from each month's curves were to be made at Kew, the central Observatory; and a table is given (page 39 of the same Report) of the results of measurements which were specially designed for the detection of *small errors* in the thermograph tabulations, from which it appears that refinements as minute as the one-hundredth of a degree of temperature were taken cognisance of in the results.

Tracings of the curves, and five-day and monthly results of the tabulations, though not the tabulations themselves, have been published, beginning with 1st January, 1869; and since then many and great improvements have been made in representing the curves on the Plates, all in the direction of greater clearness and precision, for which the Committee deserve our best thanks. Among the many valuable results of these curves we may point to the high temperature at Glasgow on the 21st April, 1873, in connection with the remarkable changes in the direction and force of the wind which occurred at the time; to the heavy rainfall at Valencia on the 2nd July, 1873, in connection with the changes of wind, temperature and pressure; and to the minute oscillations of pressure at almost all the Observatories on the 3rd and 4th July, 1873, in connection with the changeable weather at the time. In these connections the absence of any observations of clouds is, however, a serious defect.

One of the principal objects for which the seven Observatories were established was to furnish the data of observation for the determination of the meteorological "constants" for pressure, temperature, rainfall, &c., for different parts of the British Isles. This being now the seventh year in which this expensive system of observation is going forward, it may be well to inquire how far the information, as published by the Meteorological Office, meets the requirements of the problems to be solved.

Assuming that the curves are correctly traced from the photographs, we may inquire whether the figures tabulated from these, under the regulations referred to above, be satisfactorily accurate. No hourly values having been printed before January 1874, the question can only be answered by an examination of the printed monthly maxima and minima, with the days and hours of their occurrence, as compared with the curves. The following Table, giving the extreme readings of the thermometer for each of the Observatories for January 1869, is here reprinted verbatim from the Quarterly Weather Report for 1869, Part I., p. 34:—

	Maximum.	Day and Hour.	Minimum.	Day and Hour.
Valencia ...	53°·7	4th, 4 A.M.	37°·0	22nd, 3 A.M.
Armagh ...	53°·1	16th, 2 P.M.	31°·9	26th, 2 A.M.
Glasgow ...	50°·1	5th, 10 A.M	29°·5	26th, 7 A.M.
Aberdeen ...	48°·8	31st, 6 P.M.	30°·6	26th, 8 A.M.
Falmouth ...	54°·0	30th, noon.	36°·0	24th, 9 A.M.
Stonyhurst...	51°·8	31st, noon.	28°·4	25th, 2 A.M.
Kew	55°·3	30th, 6 P.M.	27°·6	25th, 7 A.M.

Each datum of this table we have compared with the temperature curves for the month, measuring each observation four times, viz., by the side scales of each curve from below upwards, and from above downwards. Setting aside every reading which does not differ from the measured reading so much as 0°·4 of a degree, and the discrepancies which appear to arise from the unequal shrinkage of the paper as indicated by the results of the four measurements, there are in the above Table twelve errors, the maxima at Falmouth and Kew being doubly wrong, the amount at the given hours being wrong, and the date of occurrence being also wrong. The following is the Table as corrected, the corrected readings being shown by asterisks:—

	Maximum.	Day and Hour.	Minimum.	Day and Hour.
Valencia ...	53°·7	* 5th, 4 A.M.	37°·0	22nd, 3 A.M.
Armagh ...	*53°·6	16th, 2 P.M	*32°·3	26th, 2 A.M.
Glasgow ...	*50°·9	5th, 10 A.M.	*27°·0	* 1st, 2 A.M.
Aberdeen ...	48°·8	31st, 6 P.M.	*28°·7	* 1st, 4 A.M.
Falmouth ...	*54°·9	*31st, 11 P.M.	36°·0	24th, 9 A.M.
Stonyhurst...	51°·8	31st, noon.	*22°·8	* 1st, 8 A.M.
Kew	*55°·8	*31st, 1 P.M.	27°·6	25th, *5 A.M.

It will be observed that the errors are of three sorts—(1) errors of temperature and errors of the date of occurrence of the maxima and minima, including (2) errors of the day of the month, and (3) errors of the hour of the day. Similarly the other months of 1869 have been examined, with the result that forty-one errors of temperature varying from 0°·4 to 9°·6 † have been detected, that the day of the month, as printed, is wrong on twenty-two occasions, and that the hour of the day is wrong in nine cases, in which the temperature and day of the month are correct—in all, seventy-two errors. The Tables and curves for ten months, taken indiscriminately from the other years, have also been examined.

In the Tables for April and June 1870 (p. 37 of the Quarterly Weather Report of that year) there occur six errors in each of these months, and in the Table for March 1871 (p. 26 of Q. W. Report for 1871) there occur seven errors. In none of the twenty-two months examined are there

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† The minimum temperature at Glasgow for October is given as 39°·9 at p. 109 of Q. W. Report, instead of 30°·3 as by the curve of temperature (Plate cxix.).

VOL. XII.—No. 293

fewer than two errors. This is the number of errors in the Table for August 1873 (p. 42 of Q. W. Report for 1873), being the last month for which the whole of the curves have been published. One of these two errors has reference to the minimum temperature for Aberdeen (39°·2) which occurred at 4 A.M. of the 11th August, and regarding which the following remark is made in a footnote:—"Doubtful; instrument out of action immediately after 6 A.M." If we turn to the Aberdeen temperature curve of the 11th (Plate xlv.), we see that the instrument was not out of order during the whole of that day; and by examining the curve for the whole month, we see further that the instrument went out of action on no day at 6 A.M., and that on the six occasions on which it was out of order during the month, it is highly probable that in none of the cases did the temperature fall so low as 39°·2.

Tables of errata for 1869 have been published by the Office from time to time, the last one appearing in November 1874. Not one of the numerous errata referring to 1869, as well as those referring to the other years, which have been detected in this examination, has yet appeared in the Tables of errata published by the Office. Furthermore, these Tables of errata are themselves repeatedly in error; thus, the last one, printed on the title-leaf of the Quarterly Weather Report for July—Sept. 1873 contains in the five lines which compose it no fewer than three mistakes; viz., 1874 being twice printed for 1873, and the hour of occurrence of the minimum at Glasgow being curiously printed as 0^{h} 2 A.M., whereas the month began with the minimum temperature.

As the curves for 1874 are not yet published, there are no means of checking the hourly tabulated readings from the curves. Referring, however, to the regulations laid down for the detection and correction of *small errors*, and to the minute refinement to which the results were to be carried, viz., to the hundredth of a degree, we were led to expect that the tabulated readings would be taken from the curves with an approach to accuracy of at least the tenth of a degree. A slight inspection of the figures of the tabulated readings shows at once that this is not the case, with the single exception of the Observatory at Stonyhurst.

A word will explain our meaning. There being no reason why any one of the ten decimal figures, viz., ·1, ·2, ·3, . . . ·8, ·9, ·0 should occur oftener than another, it is evident that on the mean of, say, a month's observations, the number of times on which a reading of a whole degree occurred would be, approximately, a tenth of the whole number of readings. At Kew, however, out of the whole 744 readings for January 1874, 172 whole degrees were read off from the curves and have been printed in the Tables; in other words, nearly 100 in excess of a due proportion. Next month matters improved at Kew, and only 87 whole-degree readings are given; in March they rose to 127, and fell again in April to 94. In this respect Kew shows the greatest irregularity of all the Observatories, but more especially as regards the tabulations from day to day—showing in this respect a marked contrast with the regular business-like tabulations of Stonyhurst. Summing up all the whole-degree readings at each of the Observatories for the nine months, and comparing the results with a tenth part of all the readings tabulated, we obtain the following results:—At Stonyhurst the number of whole-degrees read off were 16 per cent., *less* than a tenth part of the whole; at the other observatories the numbers are *greater* than a tenth part of the whole, in the following order: Kew, 50 per cent.; Aberdeen, 95 per cent.; Armagh, 112 per cent.; Falmouth, 137 per cent.; Valencia, 147 per cent.; and Glasgow, 148 per cent. Every statistician will know the meaning of these figures, and how completely they destroy the scientific character of the work. It should moreover be kept in mind that 1874 was the sixth year of the tabulation by the Observatories of the readings taken from the curves. The method of tabulation as carried out is too rough for the determination even of the temperature daily "constants"—a statement which will be self-evident from the following hourly mean values for Valencia for the month of July 1874, beginning with 1 A.M.: 57°·7, 57°·5, 57°·3, 57°·2, 57°·1, 57°·6, 58°·7, &c.; the curve for the time from 2 to 5 A.M. cannot be determined from observations in which whole degrees so largely preponderate. Though the instrumental arrangements for the continuous registration of the temperature at the Committee's seven Observatories may well be regarded as a triumph of science, yet the results, as tabulated and published, can scarcely lay claim to a higher value than eye-observations of third-rate observers.

In view of the results of this examination, it is not easy to see how one can make a scientific use of the tabulations, and results deduced therefrom, as made by this department of the Office, until (1) the tracings of the curves from the photographs, (2) the tabulations of the hourly values from the curves, and (3) the monthly and five-day means, have been carefully revised.

It cannot be said that the publications have been issued under a press of work in the Office, seeing that the Quarterly Weather Reports have been published just when the Office has been ready to do it. The last published Report is for the quarter ending September 1873, and the last quarter of 1871 only appeared in November last. Further, at page 66 of the Report for 1873, giving a list of persons in the employment of the Meteorological Committee, we learn that at the time of going to press the number so employed was twenty-four, and the sum expended in the year for their salaries amounted to about 3,727*l.*, to which, if we add 2,722*l.* for expenses at Observatories (Report for 1873, p. 32), it is evident that there can be no reasonable doubt that the staff available for this work is amply sufficient.

There is a question yet remaining to be considered, viz., Are the thermometers at these Observatories in positions which will fairly indicate the march of the temperature of each place through the hours of the day; and, above all, are they so placed as to be comparable with each other? In the Introduction to the Quarterly Weather Report for 1870, pp. iii. to vii., woodcut illustrations are given of the thermometer screens, with their positions and surroundings. No two of these are alike—the only approach to uniformity being Stonyhurst and Glasgow. Two of the Observatories, viz., Valencia and Falmouth, occupy important positions near the sea, and might have yielded valuable results with regard to the influence of the sea on climate, but they have been placed in situations so confined that their temperature observations are of little value considered as contributions to a scientific inquiry into the climate of these islands.

The Council of the Scottish Meteorological Society, in a report dated 3rd July, 1872, drew attention to the positions of the thermometers, particularly those at Aberdeen which are forty-one feet above the ground and surrounded with buildings; giving it as their opinion that "observations so made were not comparable with each other, nor with other observations."* The publication since, by the Committee, of the hourly readings, enables us to examine the point from the observations themselves. One of the best marked phases of the daily temperature, as well as one of the most important, both for scientific and practical purposes, is the increase which takes place from 9 A.M. to 3 P.M. At Kew the mean increase between these two hours for January and February 1874 was 4°·8, and for June and July 6°·7—the greater increase in the summer months being in accordance with the climatic facts. But at Aberdeen the thermometers indicated between the same hours a mean increase of 3°·7 for January and February, and 1°·8 for June and July; thus, instead of being larger in summer, the recorded difference was only half that recorded in winter. It is needless to remark that these results for Aberdeen cannot represent the temperature of this part of her Majesty's dominions, and that for the supplying of data for temperature "constants" for that part of North Britain, the observations made there are worse than useless. The arrangements for the thermometers at the seven Observatories, both as regards height above the ground, and exposure, call for reorganisation.

In Part I. of the Quarterly Weather Report for 1870 (App. pp. 8–10) appears a valuable Table of the mean monthly readings of the barometer at the Committee's telegraphic stations. If we were sure that the method of annual inspection of these stations is a sound one, the results for Holyhead might suggest an inquiry into the influence of the sea on the state of the barometer. The position of the rain-gauges above the ground at these stations, which varies from five inches to 23 feet (Q. W. Report for 1873, Part III., p. 44), calls also for revision.

In all the Reports issued by the Office it will be observed that no monthly mean temperatures for the telegraphic stations have yet been published by the Committee. With reference to these stations, Mr. Symons, in December 1869, remarked: "Various facts brought under our notice convince us that more remains to be done than has yet been effected, and that in many respects these stations [telegraphic] are unworthy of the nation of which they are to a certain extent representative."† We have no means of knowing how far matters have been rectified. It may therefore be doubted, if the Office were asked to furnish meteorological information for the use of the Registrar-General, whether they possess in their own stations the means of supplying it.

We deeply regret the position we have been forced to assume in reviewing the work of the Meteorological Office, but our duty as public journalists leaves us no choice in drawing attention to the work done in return for the annual grant by Parliament of 10,000*l*.

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* Journal Scot. Met. Soc., vol. iii. p. 290.

† *Meteorological Magazine*, vol. iv. p. 177.

ARCTIC GEOGRAPHY AND ETHNOLOGY

A Selection of Papers on Arctic Geography and Ethnology, reprinted and presented to the Arctic Expedition of 1875, by the President, Council, and Fellows of the Royal Geographical Society. (London: John Murray, 1875.)

WHILE in absolute value the Admiralty Arctic Manual must be regarded as considerably superior to the one before us, still the latter contains a great deal of matter interesting in itself and of high value as adding to our knowledge of the Arctic regions. The Geographical Society deserves thanks for the present it has made to the Arctic Expedition, and we have no doubt that the explorers will find the Selection of real service in enabling them to add to our knowledge in the directions pointed out therein. The editing of the work has been well done by Mr. Clements R. Markham.

The papers in the Geographical Society's "Collection" are arranged under the two main divisions of Geography and Ethnology, although under the former there is much that might be more properly classed under the head of Geology. The first series of papers in the geographical section, occupying about one-half of the space allotted to that section, and about one-fourth of the entire volume, is by Dr. Robert Brown. These papers consist mostly of reprints and condensations of papers by Dr. Brown, which have already appeared in various scientific publications. It seems to us that the value of these papers would have been much enhanced had the author carried condensation much further than he has done. Dr. Brown's style is often painfully slipshod; he frequently indulges in a great waste of words with inadequate result, and it would only have been courteous to those for whose behoof this compilation was made to have revised his papers most thoroughly, stating all the facts as briefly and clearly as possible.

It is unnecessary to enter here in detail into the subjects treated of by Dr. Brown, especially as most of the geological facts have recently been given in NATURE in the series of papers by Mr. De Rance (vol. xi. p. 447, *et seq.*) After describing all that is at present known of the Greenland coast-line, both east and west, Dr. Brown gives a brief account of the few journeys that have been attempted into the interior of Greenland. The country has never hitherto been crossed; if judiciously gone about the feat might very possibly be accomplished. He believes Greenland to be "only a circlet of islands separated from one another by deep fjords or straits, and bound together on the landward side by the great ice-covering which overlies the whole interior, and which is pouring its outflow into the sea in the shape of glaciers and icebergs." The general opinion undoubtedly is, as one of the greatest glacial authorities, Mr. James Geikie, puts it, that "the whole interior of the country would appear to be buried underneath a great depth of snow and ice, which levels up the valleys and sweeps over the hills," though Dr. Brown believes there are no mountains of any extent in the interior. The statement of Dr. Rink, in his paper, reprinted here, "On the Discoveries of Dr. E. K. Kane," seems to us, however, to be more philosophical. "The reality is," Dr. Rink says, "that wherever one attempts to proceed up